Savannah River Site
Solid Waste Management Department
Consolidated Incinerator Facility
Operator Training Program

CONSOLIDATED INCINERATOR FACILITY (CIF) WATER SYSTEMS (U)

Study Guide

ZIOITX16

Revision 02

_____
Training Manager / Date

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Facility Manager / Date

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REVISION LOG

REV.	AFFECTED SECTION(S)	SUMMARY OF CHANGE
02	All	Format change and change of "Process" to "Service" Water System

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

REFERENCES

1. 261-GOP-01, *Process Startup From Cold Standby to Warm Standby,* Rev. 3

2. 261-SOP-DW-01, *Domestic Water,* Rev. 2

3. 261-SOP-SW-01, *Service Water*, Rev. 3

4. Drawing W830318, *Savannah River Plant Building 261-H Area 200-H Scrubber Recirc. Tank Proc. Serv. Ppg. & Inst. Diag. (U)*

5. Drawing W830327, *Savannah River Site Building 261-H Area 200-H Domestic Water System, Pwr. Serv. Ppg. & Instr. Diag. Power and Instruments (U)*

6. Drawing W830328, *Savannah River Site Building 261-H Area 200-H Process Wtr System Sht 1 Pwr. Serv. Ppg. & Instr. Diag. Power and Instruments (U)*

7. Drawing W830329, *Savannah River Site Building 261-H Area 200-H Process Wtr System Sht 2, Pwr. Serv. Ppg. & Instr. Diag., Power and Instruments (U)*

8. Drawing W830342, *Savannah River Site Building 261-H Area 200-H Ram/Solid Feed Sh. 1, Pwr. Serv. Ppg. & Inst . Diag., Power and Instruments (U)*

9. Drawing W830344, *Savannah River Site Building 261-H Area 200-H OSOH, P&I Diagram Pwr. Serv. Ppg. & Instr. Diag., Process and Instruments (U)*

10. Drawing W830347, *Savannah River Site Building 261-H Area 200-H,, Ash Removal Unit Sh 2, Proc. Serv. Ppg. & Inst .Diag., Process and Instruments (U)*

11. Drawing W835649, *Savannah River Site Building 262-H Area 200-H, Fuel Oil & Caustic Unloading, Process Serv. Ppg. & Inst .Diag., Process and Instruments (U)*

12. Drawing W836409, *Savannah River Site Building 261-H Area 200-H, Quench Proc. Serv. Ppg. & Inst. Diag. Process and Instruments (U)*

13 WSRC-SA-17, *Consolidated Incineration Facility Safety Analysis Report*, (DOE Approval Copy 12/95)

14. ZIOISX16, *Service/Domestic Water Systems Design Description,* Rev. 0

LEARNING OBJECTIVES

TERMINAL OBJECTIVE

1.00 Given the necessary procedures and references, **OPERATE** the Water Systems to support the safe, efficient control of the Consolidated Incineration Facility (CIF).

ENABLING LEARNING OBJECTIVES

1.01 **STATE t**he purpose of the Domestic Water System in the CIF.

1.02 **DESCRIBE** the flowpath of the Domestic Water System including the origin and components supplied.

1.03 **STATE** the purpose of the Service Water System in the CIF.

1.04 **DESCRIBE** the flowpath of the Service Water System.

1.05 **EXPLAIN** the purpose of service water supplied to the following equipment/systems:

a. Offgas System
b. Mist Eliminator
c. Scrubber Recirculation Tank
d. Caustic System
e. Aqueous Waste System
f. Solid Waster Feed System
g. Chilled Water and Control Room HVAC System
h. Ashout System
i. Ashcrete Blowdown System

1.06 **EXPLAIN** the characteristics of the following equipment associated with the Service Water System:

a. Service Water Storage Tank
b. Service Water Pumps

1.07 **DESCRIBE** the function of instrumentation installed on various components in the Domestic Water System.

1.08 **DESCRIBE** the function of instrumentation installed on various components in the Service Water System.

1.09 **DESCRIBE** the controls associated with the Domestic Water System.

1.10 **DESCRIBE** the operation of controls associated with the Service Water System to include:

a. Storage tank level
b. Service water pump
c. Quench vessel spray chamber
d. Scrubber Recirculation Tank
e. Caustic system flow
f. Solid waste feed cooling water
g. Ash Receiving Tank

1.11 **EXPLAIN** the operation of the following water systems alarms and interlocks to include the interlock actuating conditions, effects, and reasons for the interlocks:

a. Domestic Water System
b. Service Water System

1.12 **DESCRIBE** the following normal operations/conditions of the Domestic Water System:

a. Initial configuration
b. S.C. Department of Health and Environmental Control (SCDHEC) Requirements
c. Startup
d. Normal operation
e. Shutdown

1.13 **EXPLAIN** the following normal operations of the Service Water System:

a. Initial configuration
b. Startup
c. Normal operation
d. Shutdown

1.14 **DESCRIBE** the routine inspections and surveillances of the water systems.

1.15 **DESCRIBE** the causes and consequences of abnormal operations associated with the water systems.

SYSTEM OVERVIEW

Safety

Many of the support systems use rotating equipment (pumps, fans, blowers, etc.) for process operations. Personnel should ensure that they do not wear chains, necklaces or loose articles of clothing in the vicinity of rotating equipment.

Many of the fuels used for incineration are not only chemically toxic, but they may present other hazards if they are spilled or leak. Personnel should take appropriate measures in dealing with spills and leaks of waste materials. Many of the corrective measures are addressed through the cognizant procedures but operators should always avoid walking through or around areas where spills or leaks have occurred.

There are numerous Eyewash & Safety Shower stations used in the event of someone being sprayed with an unknown substance. The use of any of these stations will alarm in the Control Room alerting Operations of the need for assistance.

Operators are routinely called upon to physically lift materials. Proper lifting techniques and protective gear should be used when performing any lifting.

There are numerous electrically powered components throughout the incineration facility. Proper electrical safety precautions are documented and proceduralized and should be adhered to any time that electrical equipment is being operated or aligned.

Many high pressure systems are used to support incinerator operation. Operators should exercise caution any time they are working with high pressures to ensure that they are not injured by inadvertent leaks, over-pressurization, or relieving systems to the atmosphere.

Introduction

This section describes how water is brought into the CIF and how it is used. Diagrams are provided for flowpaths for the Domestic and Service Water Systems.

SYSTEM PURPOSE

The Domestic Water (DW) and Service Water (SW) Systems are provided to supply the water requirements of the CIF. The Domestic Water System provides water to the Service Water Storage Tank, safety showers and eyewash stations, water coolers, and lavatories located throughout the facility. The Service Water System supplies, water to the Offgas System and Ash Removal System, the Control Room HVAC System, the Ashcrete Decontamination System, Offgas Blowdown Filter Wash, Emergency Quench and Scrubber Water Spray, the Mist Eliminator, and to the facility sump pumps for seal lubrication.

ELO 1.01 STATE the purpose of the Domestic Water System in the CIF.

Domestic Water

(See Table 1, *Domestic Water System Loads*.) Eighteen safety showers are located in three areas in the facility: the Tank Farm Area, the Incinerator/Ashcrete Area, and the Offgas Area. The Domestic Water System also provides the source of water for the Service Water System.

Outside Underground (OSUG) piping in the Domestic Water System, from the tap in the water distribution line to the location adjacent to the Foam Building where the piping emerges from underground, is made of PVC. The fittings used in construction of the OSUG piping are push-on, Polyethylene-lined ductile iron. The piping is insulated and heat-traced.

AREA	CLI NO.	DESCRIPTION	LOCATION
Tank Farm Area	H-262-DW-EYW-001	Safety Shower and Eyewash No 1	Platform at Spare Tank
	H-262-DW-EYW-002	Safety Shower and Eyewash No 2	Pipe Rack at Spare Tank
	H-262-DW-EYW-003	Safety Shower and Eyewash No 3	Platform at AW Storage
	H-262-DW-EYW-004	Safety Shower and Eyewash No 4	Regulated Unloading Area
	H-262-DW-EYW-005	Safety Shower and Eyewash No 5	Pipe Rack at Regulated Unloading
	H-262-DW-EYW-006	Safety Shower and Eyewash No 6	Platform at F. O. Storage
	H-262-DW-EYW-007	Safety Shower and Eyewash No 7	Clean Unloading Area
Offgas Area	H-261-DW-EYW-008	Safety Shower and Eyewash No 8	Col. 2-B Ground Floor
	H-261-DW-EYW-009	Safety Shower and Eyewash No 9	Platform at Col. 2-B

Table 1 Domestic Water System Loads

	H-261-DW-EYW-010	Safety Shower and Eyewash No 10	Col. 1-A Ground Floor
	H-261-DW-EYW-011	Safety Shower and Eyewash No 11	Col. 2-C Ground Floor
	H-261-DW-EYW-012	Safety Shower and Eyewash No 12	Col. 3-A Ground Floor
	H-261-SW-TK-001	Service Water Storage Tank	Ground Floor between Col. 3-B and 3-C
Incineration and Ashcrete Area	H-261-DW-EYW-013	Safety Shower and Eyewash No 13	Col. 4-D Ground Floor
	H-261-DW-EYW-014	Safety Shower and Eyewash No 14	Col. 4-C Ground Floor
	H-261-DW-EYW-015	Safety Shower and Eyewash No 15	Col. 4-B Roof
	H-261-DW-EYW-016	Safety Shower and Eyewash No 16	Col. 5-C Roof
	H-261-DW-EYW-017	Safety Shower and Eyewash No 17	Col. 6-B 2nd Floor
	H-261-DW-EYW-018	Safety Shower and Eyewash No 18	Col. 4-C 2nd Floor
CIF Control Room	NA	Lavatory and Water Coolers	Control Room and the Box Handling area

Table 1 Domestic Water System Loads (Cont)

ELO 1.03 STATE the purpose of the Service Water System in the CIF.

Service Water

(See Table 2, *Service Water System Loads.*) The Service Water System is primarily designed to supply service water to the offgas quench vessel and the Ash Removal System. The system receives its inventory from the Domestic Water System through a two-inch (2") fill line.

SYSTEM	DESCRIPTION	DRAWING
	Service Water to Mist Eliminator, Nozzles	W830317
	Service Water to Blowdown Tank No. 2, Nozzle	W836410
Offgas	Service Water to Blowdown Tank No. 1, Nozzle and to the Common Pump Suction Header Line	W830323
	Service Water to Filter Feed Tank and the Filter Feed and Filter Concentrate Pump Suction Lines	W830321
	Service Water to Scrubber Recirculation Tank, Nozzle	W830318
	Service Water to 1st Header Quench Spray and 4th Header Emergency Spray	W836409
	Service Water to Quench Recirculation Tank	W830316

Table 2 Service Water System Loads

Caustic	Service Water to Caustic Unloading Pump Suction Line	W835649
Aqueous Waste	Service Water to Aqueous Feed Pump Injection Line Aqueous Waste Tank	W830310
	Service Water to Ashcrete Servicing Unit	W830349
Ashout/ Ashcrete	Service Water to Ash Removal Backhoe and Ash Knife Gate Washdown	W830347
	Service Water to Ash Sump Pump Seal	W830335
Solid Waste Feed	Service Water to Ram Feed Hydraulic Unit Heat Exchanger	W830342
Chilled Water	Service Water to Chilled Water System	W830355
Service Water	Hose Reel RK-100 through 111	W830329

Table 2 Service Water System Loads (Cont)

The system also provides water to:

- Offgas and Ash Handling Systems
- Control Room HVAC System
- Ashcrete Drum Decontamination System
- Offgas Blowdown Filter Wash
- Emergency water to the Quench Vessel and the Scrubber
- Mist Eliminator Wash

Summary

- The Domestic Water System supplies all fresh water consumed in the CIF.
- Service water is the source of water for cooling the Offgas Quench Tank and the Ram Feed Hydraulic Unit.

DESCRIPTION & FLOWPATH

ELO 1.02 DESCRIBE the flowpath of the Domestic Water System including the origin and components supplied.

Domestic Water System Flowpath

(See Figure 1, *Domestic Water System Flow Diagram.*) The Domestic Water System supplies water to five main areas in the CIF:

- The safety shower manifold in the Tank Farm, the Offgas Area, and the Incinerator and Ashcrete Area
- The Service Water Storage Tank
- The control room lavatory and water cooler, and the box handling water cooler.

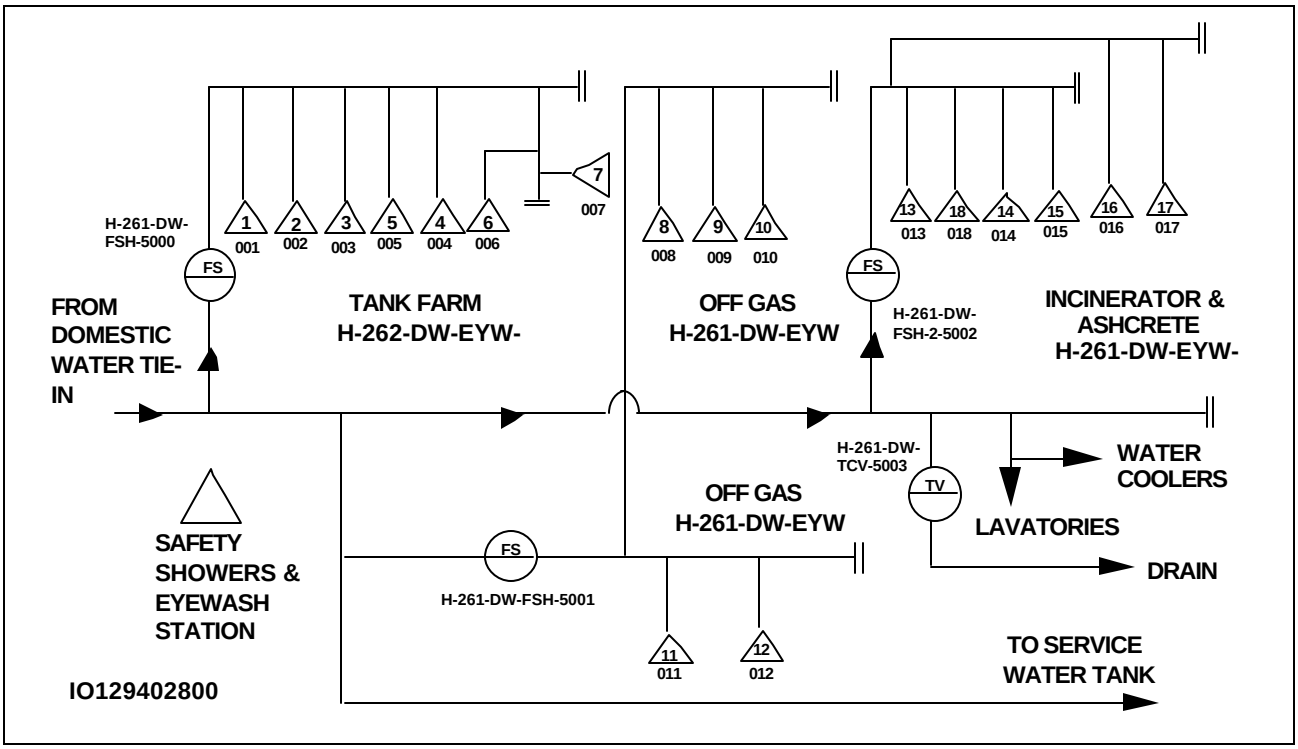

Figure 1 Domestic Water System Flow Diagram

The water supply for the Domestic Water System originates in H Area from an existing six-inch underground water distribution line. An underground six-inch (6") PVC stub is provided to tap into this distribution line. Pressure at the water distribution line tap is approximately 80-100 psig. Flow instrumentation is provided in piping at the Tank Farm Foam House.

The Domestic Water System is the source for the Service Water System and maintains the inventory in the Service Water Storage Tank (TK-001). The design peak for domestic water usage shall not exceed 136 gpm, not including the service water loads. Total load for the Domestic Water System, including the service water load, is 256 gpm.

ELO 1.04 DESCRIBE the flowpath of the Service Water System.

Service Water System Flowpath

The Service Water Storage Tank receives water from the Domestic Water System. The tank maintains a storage volume of water and provides a source of water for the service water pumps. These pumps are mounted on the discharge side of the tank and are used to pump water to the Offgas System, Ashcrete System, Ram Feed Hydraulic Unit, Control Room HVAC and the Tank Farm. (See Figure 2, *Service Water System Flow Diagram.)*

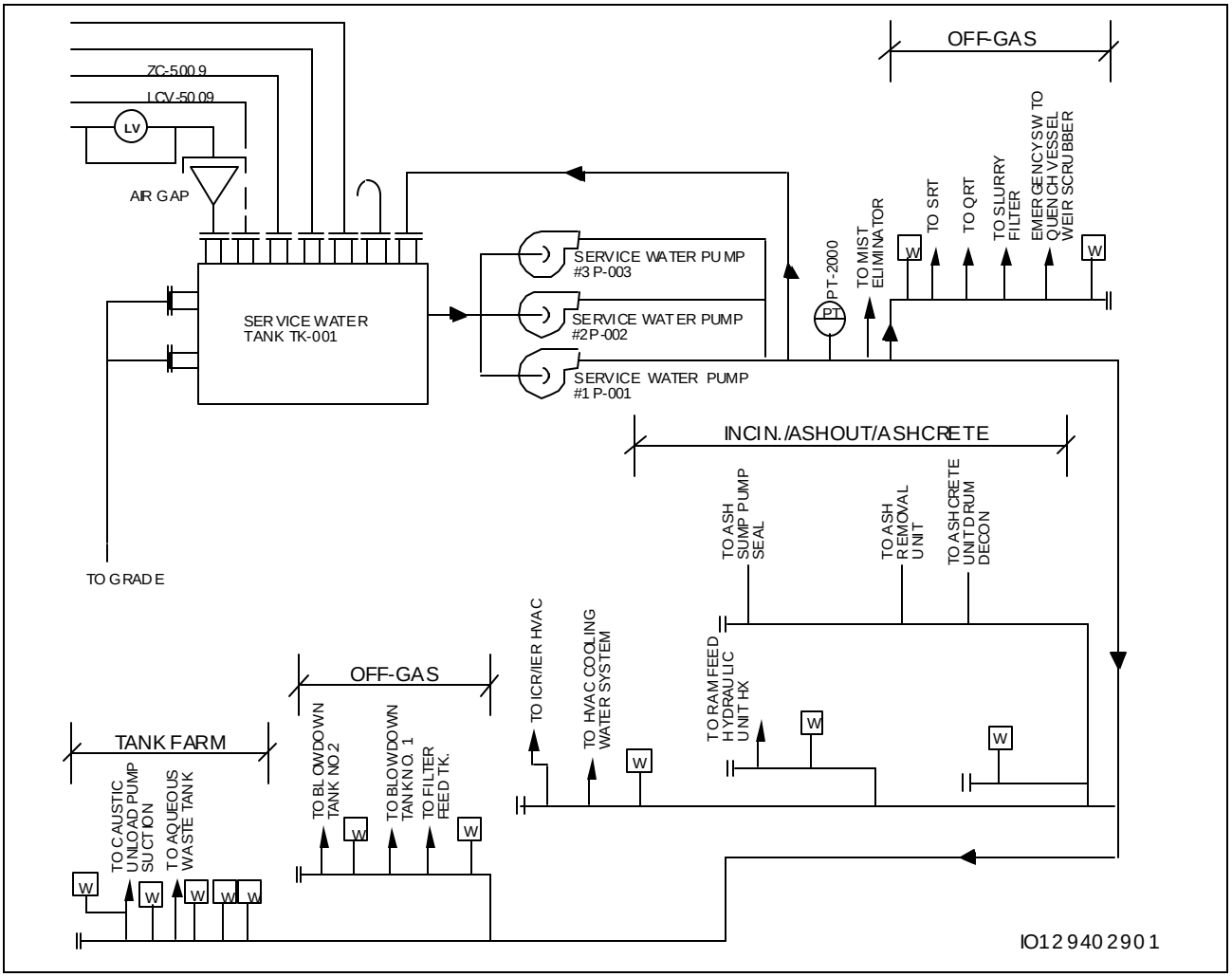

Figure 2 Service Water System Flow Diagram

Summary

- The Domestic Water System is supplied from the Site Domestic Water System. Domestic water supplies water for the safety shower and eyewash stations, potable water, and the Service Water Storage Tank.
- The Service Water System supplies water for the various services in the CIF. Water is supplied to the Control Room HVAC System, the Offgas Quench System, the Ashcrete System the Tank Farm, and the various sump pumps that require seal cooling.

MAJOR COMPONENTS

The Domestic Water System consists of piping with branches to supply water for the CIF safety showers, Service Water Tank, and potable water needs. The Service Water System is a self-contained system with a tank for its source of water and pumps to develop pressure to deliver the water to its loads. Service water is recycled and is not potable.

Domestic Water

Domestic Water Piping and Headers

The water supply for the Domestic Water System originates from underground piping which surfaces adjacent to the Building 262-1H Foam House at the Tank Farm. The piping joins the Outside Overhead (OSOH) pipe bridge in the Tank Farm. On the OSOH pipe bridge, the manifold inlet line to the Tank Farm Area branches off to the safety showers located in the Tank Farm through valve V-004. A low-point drain is located at the valve followed just downstream by H-261-DW-FSH-5000, Safety Shower Water Flow, Tank Farm. This manifold supplies seven (7) Safety Shower and Eye Wash Stations and ends at valve V-014 with a blind flange located at the Regulated Unloading Facility beneath the tank farm grating. The six-inch (6") domestic water header continues down the OSOH pipe bridge and enters Building 261-H through an overhead pipe rack in the Offgas Blowdown Area. The service water storage tank fill line branches off overhead above the beginning of the shield wall. The fill line reduces to two-inch (2") diameter immediately downstream of valve V-005 and is routed overhead to a valve station where control valve LCV-5050 maintains the tank level through the fill line into a six-inch (6") nozzle.

The Service Water Storage Tank is located in the Offgas Area on the ground floor. Immediately following the service water storage tank branch line, the manifold inlet line branches off through valve V-009 and flow switch LSH-5001 to feed the five (5) Safety Shower and Eye Wash Stations in the Offgas Area. Downstream of the flow switch, a line branches off to safety showers EYW-008, 009, and 010. The line continues to safety showers EYW-011 and 012.

A manifold inlet line branches off and is routed overhead through valve number V-010 and flow switch FSH-5002 to the six (6) Safety Shower and Eye Wash Stations in the Ashcrete Area and the Incinerator Area. Safety showers EYW-013, 014, 015, and 018 are supplied from this line. A line branches off downstream of the flow switch and supplies safety showers EYW-016 and 017. The six-inch (6") main service water header reduces to a two-inch (2”) line in the overhead above the Drummed Ashcrete Storage Area and continues into the Solid Waste Handling Area. From this two-inch (2”) header inside the Solid Waste Handling Area, a line branches off and is routed to Catch Basin No. 10, located just outside the Control Building entrance near the building HVAC fans, and through temperature control valve TCV-5003.

Domestic water supply lines to the lavatories and water coolers

Domestic water supply lines to the lavatories and water coolers branch off downstream of the catch basin line and are routed through the Solid Waste Handling Area into the control building facilities. The two-inch (2") header terminates overhead inside the Solid Waste Handling Area at valve V-013 and a blind flange.

Domestic Water Safety Showers and Eyewash Stations

The Domestic Water System supplies water to safety showers located throughout the CIF. There are currently 18 safety showers in the CIF. These showers are located in strategic areas on four (4) separate manifold inlets where personnel could potentially become contaminated or be exposed to chemical hazards. The system is designed to ensure that approximately 30 gpm is available to the last shower in a manifold. Water from showers is collected in drain pans and piped through floor drains to the building sumps. The Domestic Water System also supplies water to the facility lavatories and water coolers throughout the facility.

The safety shower manifold inlets in the Tank Farm, the Offgas Area, and the Incinerator and Ashcrete Area also contain flow switches FSH-5000, FSH-5001 and FSH-5002, respectively. These flow switches activate alarms on the DCS FAH-5000, FAH-5001, and FAH-5002, respectively, when high flow in excess of the setpoint is detected.

Safety showers are located in three (3) areas of the CIF: the Tank Farm, the Offgas Area, and the Incinerator/Ashcrete Area. Seven (7) safety showers are located in the Tank Farm Area; five (5) in the Offgas Area and six (6) in the Incinerator/Ashcrete area. Minimum of 30 gpm is supplied to each safety shower. The Domestic Water lines to the Safety Showers and Eyewash Stations are heat traced to keep the water from decreasing below 60° F

ELO 1.05 **EXPLAIN the purpose of service water supplied to the following equipment/systems:**

a. Offgas System
b. Mist Eliminator
c. Scrubber Recirculation Tank
d. Caustic System
e. Aqueous Waste System
f. Solid Waster Feed System
g. Chilled Water and Control Room HVAC System
h. Ashout System
i. Ashcrete Blowdown System

Service Water

Service Water Supply to the Offgas System

Offgas System requirements necessitate that an emergency source of quench water be available to quench exhaust gases exiting the Secondary Combustion Chamber (SCC). The Service Water System is designed to meet the requirements as one of the sources for the quench tank (TK-002). A direct spray is provided into the quench tank at the First Quench Spray Header and at the Emergency Spray Header (fourth header in the quench tank). This spray cools the SCC exhaust gas stream by injecting service water into each header at a minimum pressure of 30 psig and at a flow rate of 80 gpm. The emergency spray is initiated by one of the following:

- Manually by operating hand switch HS-4005
- A HIGH temperature out of the Quench Tank TS-3002 A or B
- A HIGH temperature scrubber outlet temperature TS-3009 A or B
- Opening valve FV-4005 and transferring the operating service water pump to fast speed

Service Water Supply to the Mist Eliminator

The service water is also designed to supply water to Mist Eliminator (VAPX-001) for washing the two separation modules internal to the Mist Eliminator. The service water is injected into two separate headers upstream of the first module's Kyner mesh pad. Each header has two sprays which direct the service water on to the mesh pad to wash particulate matter. Spray is provided to the two headers at 10 gpm and 30 psig for each header. Service water is also supplied to two additional headers located between the two modules. These two headers contain four sprays each and are supplied water at 20 gpm and 30 psig. The system is designed to continuously provide

water at 10 gpm and 30 psig to one of the two upstream sprays, if necessary, to provide continuous cleaning.

Service Water Supply to the Scrubber Recirculation Tank

Service Water is automatically supplied to the Scrubber Recirculation Tank H-261-TK-001. The tank level is controlled through a differential pressure transmitter which measures tank level and causes the operation of a level control valve.

Service Water Supply to the Offgas Tanks

Service water is also designed to provide water to Blowdown Tanks 1 and 2 (OGB-TK-001 and 002) and their common pump suction header, the Filter Feed Tank (TK-003) and its pump suction lines, and the Quench Recirculation Tank for maintaining tank level and/or flushing. These functions are all manually initiated in the facility.

Service Water Supply to the Caustic System

Service water is designed to provide water to the Caustic System to dilute a 50% sodium hydroxide concentration to 20% for transfer to the Caustic Tank in the Offgas Area. This dilution is performed by injecting service water into the suction piping of the Caustic Unloading Pump (P-0053). The service water flow is controlled by a magnetic flowmeter which measures the flow and compares the value with a second magnetic flowmeter located in the pump discharge piping. The flow ratio is determined, and a signal is sent to a flow control valve which adjusts service water flow to the proper rate.

Service Water Supply to the Solid Waste Feed System

The Service Water System is designed to supply cooling water to the Ram Feed Hydraulic Unit Heat Exchanger (HTEX-001). The cooling water flow is controlled by temperature control valve TV-6217. The temperature of the hydraulic unit is monitored by temperature element TE-6205 which provides input to the temperature control valve to provide cooling water. The cooling water returns back to the Service Water Storage Tank.

Service Water Supply to the Chilled Water and Control Room HVAC System

The Service Water System is designed to supply water to the Chilled Water System through a pressure regulating valve PV-078, (NOTE: currently not used). A quick-fill bypass line around the pressure regulating valve is also available, (NOTE: currently this is the method of choice for makeup to the tank). Service water is also provided to the fan coil ACU-001 in the Control Room HVAC System.

Service Water Supply to the Ashout System

The Service Water System supplies water to the Ash Receiving Tank (TK-001) to maintain the water level during Ashout System operation. The water also maintains a seal between the Rotary Kiln (RK) and the Ashout Enclosure. Water is supplied to the tank through a one-inch (1") line into the upper region of the tank. Water is added to the tank until high level indication is received. The system also has service water available to wash down the backhoe chute and the Ash Knife Gate (GATE-001).

Service Water Supply to the Ashcrete System

Service water is also provided to the Ashcrete Servicing Unit. In the servicing unit, service water is provided to mix with the wet ash and cement to form stable ashcrete to be sealed in drums for disposal. The water to be mixed in the drums is piped to a small holding tank located inside the Ashcrete Servicing Unit. Water is also supplied to the Spray Decontamination System to spray down the unit's insides and drum upon completion of a mixing cycle. Service water provided to the Ashcrete Servicing Unit is controlled at the Ashcrete Local Control Room.

1.06 **EXPLAIN the characteristics of the following equipment associated with the Service Water System:**

a. Service Water Storage Tank
b. Service Water Pumps

Service Water Storage Tank

The Service Water Storage Tank is sized to ensure that a two-hour inventory of emergency offgas quench water is available. This capacity ensures that approximately 4,000 gallons of water is available to the quench when necessary. The Service Water Storage Tank is a 6,000 gallon tank located at ground level in the Offgas Area. Domestic water enters the tank through a two-inch (2") fill line. An air gap between the domestic water fill line and the Service Water Storage Tank prevents the siphoning of the tank contents and the possible contamination of the Domestic Water System.

Service Water Pumps

Three service water centrifugal pumps transfer service water from the Service Water Storage Tank to the various areas in the CIF. The pumps are two-speed pumps, operating at 1150 and 1750 rpm. At low speed the pumps are designed to deliver 100 gpm at 38 psig Total Dynamic Head, and at high speed 195 gpm at 88 psig Total Dynamic Head. One pump is continuously operating to meet the CIF service water needs. The remaining pumps are in standby and will automatically be started by the DCS as required.

The system includes a recirculation line to recirculate minimum flow back to the Service Water Storage Tank through restricting orifice FO-5057. This orifice is sized to allow minimum flow to return to the Service Water Storage Tank to prevent pump damage if downstream valves inadvertently close when a pump(s) is(are) running or during low or no-flow conditions.

One pump is powered from MCC 7 and the other two pumps are supplied from MCC 8. Pump electrical power supplies are arranged to maintain cooling water to the scrubber and quench system equipment in the event of a loss of power.

Summary

- The Domestic Water System provides water to 18 safety showers located on four, four 4-inch manifolds throughout the CIF. The system is designed to ensure that approximately 30 gpm is available to the last shower in a manifold. Flow switches in the manifold inlet lines annunciate on high flow.
- Domestic water supplies makeup water to the Service Water Storage Tank and provides potable water for the CIF.
- Service water restores water losses in the Chilled Water and Offgas Systems.
- Cooling for the Ram Feed Hydraulic Unit Heat Exchanger and emergency cooling for the Offgas Quench are provided by the Service Water System.
- The separation modules in the Mist Eliminator, the spool piece assembly and Ash Knife Gate, and the Spray Decontamination System, are all supplied by service water.
- Service water provides makeup water to the Ashout System, water for mixing with cement to the Ashcrete System, and water for flushing the Aqueous Waste Tanks and Blowdown Tanks.
- Service water supplies water to the Caustic Unloading Station to dilute the caustic prior to pumping to the Caustic Tank in the Offgas Area.

INSTRUMENTATION

Water flow, pressure, and service water tank level indications are provided to operators by instruments described in this section.

ELO 1.07	**DESCRIBE the function of instrumentation installed on various components in the Domestic Water System.**

Domestic Water

Flow Instrumentation

Domestic water flow is measured by magnetic flowmeter FT-6900 located in the above-ground piping near Building 262-1H, Foam House. The flow meter is supplied power from Instrument Power Panel D, breaker BKR-C03. A 4 - 20 ma DC signal is generated and sent to flow indicator FI-6900 on the DCS to provide flow indication in the Control Room. Flow is also totaled by totalizer FQI-6900.

Flow switch LSH-5001 is used to feed the safety showers in the Offgas Area. Indication of flow through a safety shower manifold is also provided to the Control Room.

Table 3, *Domestic Water Flow Switch Data,* shows flow information.

CLI NUMBER.	MANIFOLD	POWER PANEL	ALARM
H-261-DW-FSH-5000	Flow to Tank Farm Safety Shower	D	FAH-5000
H-261-DW-FSH-5001	Flow to Offgas Safety Shower	C	FAH-5001
H-261-DW-FSH-5002	Flow to Incinerator /Ashcrete Shower	B	FAH-5002

Table 3 Domestic Water Flow Switch Data

Pressure Instrumentation

Domestic water pressure is measured by pressure transmitter PT-6900 located in the above-ground piping near Building 262-1H, Foam House. The pressure transmitter sends a 4 - 20 ma DC signal to pressure indicator PI-6901 to provide pressure indication in the Control Room. A signal also is sent to alarm switch PSL-6901 which generates a "Low Domestic Water Pressure" alarm on the DCS. Local pressure indication is also provided in the above-ground piping near the pressure transmitter by pressure indicator PI-6902.

ELO 1.08	**DESCRIBE the function of instrumentation installed on various components in the Service Water System.**

Service Water

Storage Tank Level Instrumentation

Service Water Storage Tank (TK-001) level is monitored by differential pressure transmitter LT-5050 which provides tank level indication to the DCS. Tank level alarms LOW-LOW LALL-5050, LOW LAL-5050, and HIGH LAH-5050 are also generated and displayed on the DCS.

Pump Instrumentation

Table 4, *Service Water Pump Control Room Indication*, provides the control room indications available to the operators to monitor pump status.

CLI NUMBER	DESCRIPTION	FUNCTION
H-261-SW-QI-5056-(A)	SW Pump LOW SPEED, SW-P-5056-(A)	Status Light
H-261-SW-QI-5056-(C)	SW Pump LOW SPEED, SW-P-5056-(B)	Status Light
H-261-SW-QI-5056-(E)	SW Pump LOW SPEED, SW-P-5056-(C)	Status Light
H-261-SW-QA-5056-(A)	Primary Pump Failure	Alarm Light
H-261-SW-QI-5056-(B)	SW Pump HIGH SPEED, SW-P-5056-(A)	Status Light
H-261-SW-QI-5056-(D)	SW Pump HIGH SPEED, SW-P-5056-(B)	Status Light
H-261-SW-QI-5056-(F)	SW Pump HIGH SPEED, SW-P-5056-(C)	Status Light

Table 4 Service Water Pump Control Room Indication

Flow Instrumentation

Service water flow is monitored to the Caustic Unloading Pump, and flow indication is displayed in the Control Room by FI-0056-(A).

Scrubber recirculation tank flow is measured by flow meter FT-3300 and displayed in the Control Room by flow indicator FI-3300. Flow to the tank is totaled by totalizer FQ-3300.

Pressure Instrumentation

Local system pressure indication is displayed by PI-5055 located on the pump discharge header.

Emergency spray water to the Quench Vessel is monitored by pressure transmitter PT-4000. The pressure transmitter sends a 4 - 20 ma DC signal to the DCS. This signal is converted and displayed by pressure indicator PI-4000 in the Control Room. If service water pressure falls below the setpoint, a signal is generated by pressure switch PSL-4000 to provide low pressure alarm indication in the control room on alarm indicator PAL-4000.

Differential pressure instrumentation is provided across service water filter FLT-001 to alert operators of a clogging condition in the inlet piping to the Filter Feed Tank. Differential pressure across the filter is monitored by differential pressure switch PDS-3613, which sends a signal to the DCS and indicates a HIGH DP alarm on PDAH-3613.

Summary

- Domestic water is provided to the CIF from the Site Domestic Water System. Flow meters provide indication when safety showers and eyewash stations are in use. A flow totalizer on the main branch allows Operations to monitor water usage in the CIF. Pressure is indicated and a low-pressure alarm is provided to annunciate when water pressure falls below the minimum acceptable level.
- Service water storage tank level is indicated along with service water system pressure and pump status. Service water flow is monitored to the Caustic Unloading Pump, the Scrubber Recirculation Tank and the Ash Receiver Tank. Flow to the Scrubber Tank is also totaled.
- Pressure to the emergency spray line is monitored and will annunciate on low pressure.
- Differential pressure indication across the service water filter is provided to alert operators that the filter to the Filter Feed Tank is clogging.

CONTROLS, INTERLOCKS AND ALARMS

This section describes methods used to operate the water systems, both manual and automatic, and the conditions that cause changes to the systems. Also discussed are methods to protect the water systems from adverse conditions.

ELO 1.09	**DESCRIBE the controls associated with the Domestic Water System.**

Controls

Domestic Water System Control

The control basis of the Domestic Water System is passive in nature. The system receives domestic water from the H-Area domestic water distribution line. Control of the system is limited to control of individual components rather than total system control. System pressure is available only when isolation valves V-6900-(A) and (B) are open. Operation of safety showers, eye wash stations, lavatories and coolers are based on the immediate needs of personnel.

Domestic Water Piping Temperature Control

In addition to heat tracing on domestic water piping, the system is equipped with a temperature element TE-5003 that senses outside temperature. When outside temperatures approach freezing, the temperature element opens temperature control valve TCV-5003 to allow continuous domestic water flow to Catch Basin No. 10 to prevent freezing in the piping.

ELO 1.10	**DESCRIBE the operation of controls associated with the Service Water System, to include:** **a. Piping temperature** **b. Storage tank level** **c. Service water pump** **d. Quench vessel spray chamber** **e. Scrubber Recirculation Tank** **f. Caustic system flow** **g. Solid waste feed cooling water** **h. Ash Receiving Tank**

Service Water System Control

The SW pumps have field-mounted, "MANUAL/OFF/AUTO," (MOA) switches and "START" pushbuttons for local system operation. During normal operations the MOA switches are in AUTO and the SW System is controlled from the Distributive Control System (DCS).

The three SW pumps are designated as primary, first secondary, and second secondary. The primary pump is the pump selected as the lead (running) pump. The first secondary pump will start when the primary pump is running and a Low system pressure condition occurs. The second secondary pump will start when the primary pump is running and there is a failure of the first secondary pump to start, or a Low-Low system pressure condition occurs. The pump designation is selected from the DCS selector switch HS-5056(A).

The SW pump discharge pressure is monitored by pressure transmitter PT-5051. The transmitter sends a signal to the DCS, giving indications and alarms as well as providing interlocks for Low and Low-Low discharge pressure.

When the primary pump is running, a High offgas scrubber inlet temperature, DCS Point Tag Display OGS 3002T-1, HIGH OGS INLET TEMP, or a High offgas scrubber outlet temperature, DCS Point Tag Display OGS 3009T-1, HIGH OGS OUT TEMP, will cause a service water pump to transfer to high speed.

A SW tank Low-Low level, DCS Point Tag Display SW 5050 LC-1, PROC WTR TK LEVEL CTRL., will cause the running SW pump(s) to stop and prevent starting any idle pumps.

A SW system Low pressure, DCS Point Tag Display SW 5051 P-1, PROCESS WTR PRESSURE, will cause the First Secondary Service Water Pump to start.

A SW system Low-Low pressure, DCS Point Tag Display SW 5051 P-1, PROCESS WTR PRESS, will cause the second secondary service water pump to start.

Following a loss of power incident a SW Pump will be started as part of the DCS logic following repowering from the Standby Diesel Generator.

Quench Vessel Spray Chamber

Service water flow control valve FV-4005 is interlocked to temperature switches TSH-3002 and 3009. Either temperature switch will energize solenoid valve FY-4005, opening FV-4005 on high temperature. Valve FV-4005 can also be opened by hand switch HS-4005. The Incinerator is also shut down through an interlock with the Offgas System when HS-4005 is opened.

Scrubber Recirculation Tank Control

Scrubber recirculation tank level is controlled by transmitter LT-3301 and differential pressure transmitter DT-3301. These transmitters input 4 - 20 ma DC signals into the DCS which compares the input to the setpoint of level controller LIC-3301. A 4 - 20 ma DC output signal is sent to signal transducer CNV-3301 which converts the signal to a pressure and positions level control valve LCV-3301 to inject water into the tank.

Caustic System Flow Control

Service water flow to the Caustic System is controlled by magnetic flow meter FT-0056-(A) and FT-0056-(B). The two flow meters provide input to flow controller FIC-0056 which adjusts service water flow control valve FCV-0056 to establish proper dilution of caustic into the **Caustic Storage Tank**.

Ash Receiving Tank Level Control

Ash receiving tank level instruments LE-6357-(A) and (B)) control tank level by activating a control valve FV-6357 on a low tank level. Water is added to the tank until high level indication is received at which time the valve closes. The system also has available service water to wash down the backhoe chute and the Ash Knife Gate, GATE-001 by operating hand switch HS-6359. Operation of this switch opens control valve FV-6359 to deliver flush water to the Ash Knife Gate.

Solid Waste Feed Cooling Water Flow Control

The cooling water flow is controlled by temperature control valve TV-6217. The temperature of the hydraulic unit is monitored by temperature element TE-6205 which provides input to the temperature control valve to provide cooling water.

ELO 1.11	**EXPLAIN the operation of the following water systems alarms and interlocks, to include the interlock actuating conditions, effects, and reasons for the interlocks:** **a. Domestic Water System** **b. Service Water System**

Interlocks

(See Table 5 *Domestic and Service Water Interlocks and Alarms*.) There are no interlocks associated with the Domestic Water System. Service Water System components are interlocked with different functions and parameters in the CIF.

ALARM POINT	DESCRIPTION	INSTRUMENT NO.\ LOCATION	INTERLOCK NUMBER
H-261-DW-FAH-5000	Safety Shower Water Flow Tk Farm	H266-5000FS \ FIELD	n/a
H-261-DW-FAH-5001	SAfety Shower Water Flow Offgas	H266-5001FS \ FIELD	n/a
H-261-DW-FAH-5002	Safety Shower Water Flow Incinerator	H266-5002FS \ FIELD	n/a
H-261-SW-LALL-5050	Level,LOW-LOW, SW-TK-001	H266-5050-LS \ DCS	G4
H-261-SW-LAL-5050	Level, LOW, SW-TK-001	H266-5050-LS-1\ DCS	n/a
H-261-SW-LAH-5050	Level, HIGH, SW-TK-001	H266-5050-LS-2\ DCS	n/a
H-261-SW-PALL-5051	Pressure LOW-LOW, Service Water	H266-5051-PS \ DCS	G2
H-261-SW-PAL-5051	Pressure Low, Service Water	H266-5051-PS-1\ DCS	G1
H-261-SW-QA-5056-(A)	Primary Pump Failure	PLC \ PLC	G3
H-261-DW-PAL-6901	Pressure, Low, Domestic Water Inlet	H802-6901-PS \ DCS	n/a

Table 5 Domestic and Service Water Interlocks and Alarms

Service Water Storage Tank

The ?P transmitter LT-5050 provides tank level indication to the DCS and generates a permissive which is interlocked to prevent a pump start on low-low tank level.

Service Water Pumps

The primary pump is interlocked to automatically transfer to high speed on high quench exhaust temperature TSH-3002 or high scrubber outlet temperature TSH-3009.

Quench Vessel Spray Chamber

Service water flow control valve FV-4005 is interlocked to temperature switches TSH-3002 and 3009. Either temperature switch will energize solenoid valve FY-4005, opening FV-4005 on high temperature. Valve FV-4005 can also be opened manually by hand switch HS-4005. When HS-4005 is opened the Incinerator is shut down through an interlock with the Offgas System.

Ashout System

Conductivity probes LE-6357-(A) and (B) are interlocked to energize or de-energize solenoid valve FY-6357, opening and closing flow control valve FV-6357. A signal from either conductivity probe will open the flow control valve.

Limits

Domestic Water System

The Domestic Water System is designed to meet the following system parameters:

Peak Water Usage (not including service water)..... 136 gpm
Line Pressure (at tap to water distribution line)..... 80-100 psig
Minimum Flow Rate per Safety Shower..... 30 gpm

Service Water

The Service Water System is designed to meet the following system parameters:

System Usage ..... 120 gpm

Pump Flow Rate

High Speed..... 195 gpm
Low Speed..... 100 gpm
Service Water Storage Tank ..... 6,000 Gallons

Limitations and Precautions

Domestic water system components alarm on the DCS when system parameters are exceeded. There are also parameters in the Service Water System that initiate alarm conditions in the DCS. The domestic and service water system interlocks and alarms are identified in Table 5, *Domestic and Service Water Interlocks and Alarms.*

Setpoints

Domestic and Service Water Systems have various setpoints that initiate actions to alert operators of plant conditions or that initiate automatic system responses. (See Table 6, *Domestic and Service Water Setpoints.)*

CLI NUMBER	DESCRIPTION	ENG UNITS	SET POINT	RESET POINT
H-261-DW-FSH-5000	Flow, High, To Tank Farm	GPM	Set to flow wash	of the eye- station.
H-261-DW-FSH-5001	Flow, High To Off Gas Area	GPM	2.0	1.5
H-261-DW-FSH-5002	Flow, High, Incinerator/ Ashcrete Area	GPM	2.0	1.5
H-261-DW-TE-5003	Element, Temperature, Capillary For TCV-5003	°F	N/A	N/A
H-261-DW-FT-6900	Flow Domestic Water Inlet	GPM	0 - 175	NA
H-261-DW-PSL-6901	Pressure, Low, Domestic Water Inlet	Psig	40	1%
H-261-DW-PT-6901	Pressure, Domestic Water Inlet	PSIG	0 - 150	NA
H-262-SW-FT-0056-(A)	Flow, Process Water To Caustic	GPM	0 - 70	NA
H-261-SW-FT-3300	Flow, Magnetic, to OGS-Tk-001	GPM	0 - 150	NA
H-261-SW-PDSH-3613	D/P, High, SW-FLT-001	PSID	10	8.5
H-261-SW-PT-4000	Pressure, To Off Gas Quench	PSIG	0 - 100	NA
H-261-SW-LSLL-5050	Level, Low-Low, SW-TK-001	IN	18	1%
H-261-SW-LSL-5050	Level, Low, SW-TK-001	IN	24	1%
H-261-SW-LSH-5050	Level, High, SW-TK-001	IN	105	1%
H-261-SW-LT-5050	LEVEL, SW-TK-001	IN	0 - 114	n/a
H-261-SW-PSLL-5051	Pressure Low-Low Service Water	PSIG	25	1%
H-261-SW-PSL-5051	Pressure Low Service Water	PSIG	30	1%
H-261-SW-PT-5051	Pressure, Service Water Outlet Header	PSIG	0 - 100	NA

Table 6 Domestic and Service Water Setpoints

Summary

- The Domestic Water System is under the control of H Area.
- A temperature control valve in the CIF opens on low outside air temperature to provide continuous flow when air temperature is below the low limit. This flow is instigated to prevent the piping from freezing.
- Domestic Water System is rated at 136 gpm peak flow with a nominal flow of 80 gpm. Piping is sized so the system provides at least 30 gpm to any safety shower at rated pressure.

SYSTEM INTERRELATIONS

Domestic Water

The Domestic Water System interfaces with the DCS and the Service Water System. The domestic water system flow will be adjusted based upon the level in the Service Water Storage Tank. The DCS monitors tank level and the signal sent from the tank level controller adjusts the position of the domestic water flow control valve.

Service Water

Service water interfaces with the following systems:

Domestic Water

Service water storage tank level controller sends a signal to domestic water flow control valve to adjust flow to the Service Water Storage Tank.

Solid Waste Feed

Service Water System is designed to supply cooling water to the Ram Feed Hydraulic Unit Heat Exchanger (HTEX-001). The cooling water flow is controlled by the temperature control valve to provide cooling water. The cooling water returns back to the Service Water Storage Tank.

Caustic

Service water flow to the Caustic System is provided for dilution of concentrated caustic. The caustic flow controller (FIC-0056) adjusts service water flow control valve FCV-0056 to establish proper dilution of caustic into the storage tank.

Ash Handling

Service water is designed to supply water to the Ash Receiving Tank (TK-001) maintaining the tank level between the Hi and Lo level alarms during Ashout System operation. The water maintains a seal between the RK and the Ashout Enclosure. The system also has available service water to wash down the spool piece assembly and Ash Knife Gate (GATE-001).

Offgas Quench

Offgas System requires an emergency source of quench water be available to quench exhaust gases exiting the SCC. The Service Water System is designed to meet the requirements as one of the sources for the Quench Tank (TK-002).

Offgas Blowdown

Service water is designed to provide water to OGB-TK-001 and 002 and their common pump suction header for maintaining tank level and/or flushing.

Offgas Scrubber

Service water is automatically supplied to the Scrubber Recirculation Tank (TK-001) as makeup water.

Chilled Water

Service water is designed to supply water to the Chilled Water System for heat exchanger cooling and for makeup.

Aqueous Waste

Service water is provided to the Aqueous Waste Tank (TK-004) for cleaning and flushing.

HVAC

Service water is provided to the fan coil (ACU-001) in the Control Room HVAC System for cooling.

DCS

Service water storage tank level control is through the DCS. Pump operation is also performed through the DCS.

Standby Diesel Generator

The diesel provides emergency power for the operating pump(s) in the event of a loss of normal power.

Summary

- The Domestic Water System is supplied by the Site Domestic Water System and provides water for the safety showers, emergency eyewash stations, Service Water Storage Tank and potable water loads in the CIF.
- The Service Water System is supplied by the Domestic Water System and provides water for Aqueous Waste, Ashcrete, Ashout, Caustic, Chilled Water, Offgas Blowdown, Offgas Quench, Offgas Scrubber, and Solid Waste Feed. The DCS and Standby Diesel Generator support the Service Water System.

INTEGRATED PLANT OPERATIONS

Normal Operations

Operation of the Water Systems in the Operating Mode, the Warm Standby Mode, the Cold Standby Mode, and while shutdown are described. Also the State Requirements for operating the Domestic Water System, a potable water supply, are given.

Domestic Water System

The main purpose of the Domestic Water System is to provide domestic water to safety showers, building lavatories and water coolers, and the Service Water System. During normal operations, the system is pressurized and capable of supplying water on demand. Safety showers and eyewash stations are operational. Lavatories and water coolers are available for use. Water is being supplied to the Service Water Tank as dictated by the level controller. System instrumentation is monitoring and recording flow through the system.

Initial Configuration

In the initial configuration, the domestic water distribution line, under the jurisdiction of the Area Power Group, is available and isolation valves are positioned to supply water to CIF Domestic Water System. System valves and DCS point displays are aligned as required per procedure 261-SOP-DW-01, *Domestic Water*.

South Carolina Department of Health and Environmental Control (SCDHEC) Requirements

Prior to initial system fill, during depressurization or after system integrity has been compromised, the water systems must be sampled with analysis performed by 772-D Water Quality Laboratory or another state-certified private laboratory. The Site Services Group is responsible for disinfection, flushing, and bacteriological sampling of Domestic Water Piping Systems following line breaks, leaks, repairs, new installations, modifications, or depressurization. Site Services is also responsible to ensure that all SCDHEC notification requirements are met.

Startup

In the transition from initial configuration to normal operations, procedure 261-GOP-01, *Service Startup From Cold Standby to Warm Standby*, is performed to ready the support systems necessary to support Warm Standby. In system startup, the system has been disinfected by the Area Power Group. A water sample has been taken for analysis and found acceptable, and all proper notifications to SCDHEC have been completed.

The system startup requires venting and flushing water systems piping. Venting or flushing a line requires operators to notify the Area Power Group of an expected increase in domestic water flow rates to prevent system upsets due to unexpected transients. Venting removes any residual water, air, entrained vapors or gases from the headers and lines.

Venting is performed to prevent cavitation, erosion, and water hammer in the water systems piping and components. Venting requires the installation of a leak collection system to route any residual water to the sumps, removal of a blank flange, and a gradual opening of header valves. Maintenance will install the leak collection devices. Leak collection devices are a combination of fabricated hoses, funnels, flanges or blind flanges fitted with hose fittings, drip/catch pans, and barrels or other containers specifically made to collect flush water or drainage from service piping. Maintenance mechanics will also be responsible for the removal and replacement of blank flanges for filling and venting the piping. Care should be exercised when removing blank flanges to prevent possible injury due to pressurized headers.

Flushing is routinely performed when a header or line has been drained for maintenance or if suspected contaminants or out-of-limit chemical concentrations exist. Flushing the piping removes any residuals or unwanted contaminants or chemical concentrations in the headers. Prior to flushing water systems piping, signs will be posted to notify personnel that flushing and venting are occurring, and any water draining is not for personal use. This is to prevent personnel from the possibility of ingesting harmful chemicals or contaminants. When flushing is terminated after a duration specified by supervision, the water in the piping will be tested. After subsequent tests are performed and satisfactory results are obtained, use of the water systems piping is permitted.

Flushing of the headers and lines may be performed when leak collection devices are installed, blank flanges have been removed, and all regulatory requirements have been verified. Again, notification is given to the Area Power Group of an expected increase in domestic water flow rates. When the Area Power Group has acknowledged, the area or header isolation valve will be throttled open a few turns to permit slight flow through the headers. The system will be vented when a solid, steady stream of water is observed flowing through the open blank flange(s) into the leak collection device(s). Flushing the piping may continue for an indeterminate period of time after it has been vented. Operators should monitor local pressure gauges on the headers and lines to ensure indications are consistent with flushing occurring. If pressure or flow abnormalities are evident or if unusual noises or vibrations are observed, the operators should investigate and ensure that there are no obstructions to flow or undesirable conditions in the system.

It should also be noted that in certain instances, high concentrations of chlorine or sodium hypochlorite may be added by the Area Power Group during domestic water treatment as disinfectants. Water containing these solutions should not be drained to a sanitary sewer since this may cause an upset at the sanitary waste water treatment plant.

ELO 1.12	**DESCRIBE the following normal operations/conditions of the Domestic Water System:** **a. Initial configuration** **b. S.C. Department of Health and Environmental Control (SCDHEC) Requirements** **c. Startup** **d. Normal operation** **e. Shutdown**

Normal Operation

During normal operation, the system is pressurized and water is available to all supported systems. All instrumentation is operable and is monitored on the DCS. Service water tank level is automatically maintained.

The Domestic Water System performs functions in all normal operating conditions associated with Mode 1 (OPERATION), Mode 2 (WARM STANDBY), and Mode 3 (COLD STANDBY). Normal operating conditions are defined as those planned operations that are performed on a routine basis within the accepted operations and design parameters, and which involve steady-state operations or orderly transitions between operating modes.

Mode 1 - Operations

During Mode 1 operations, the Domestic Water System distributes domestic water throughout the CIF facility to safety showers, lavatories, and coolers. The system is also automatically maintaining the Service Water Storage Tank level between 24" and 105" through the two-inch (2") fill line. The system pressure and flow rate is monitored at the location where the supply line comes above ground between the tap into the H-Area distribution line and the OSOH pipe bridge. These indications are displayed in the Control Room. A low system pressure alarm is activated in the Control Room if system pressure falls below the setpoint. Additionally, a high flowrate alarm is activated if high flow is detected in the areas supplied by the system.

Mode 2 - Warm Standby and Mode 3 - Cold Standby

During Mode 2 and 3 operations, system pressure and flow are monitored as in Mode 1. System demand from the Domestic Water System is reduced or not required. In Mode 3, the system may be shut down for maintenance, or portions of the system isolated for specific activities.

Shutdown

In Shutdown Mode, the CIF transition through the General Operating Procedures is complete and domestic water support is no longer required. The Area Power Group and CIF personnel are notified of the shutdown of the CIF Domestic Water System. Procedure 261-SOP-DW-01, *Domestic Water*, is performed to complete system shutdown.

Certain depressurizations and, in some instances, shutdown of the Domestic Water System will require the addition of chlorine or disinfectant by the Site Services Group. If the system shutdown is for a period of time that will require a chlorine or disinfectant concentration level to be maintained, the Site Services Group will inject the chemicals at shut-down concentrations into the piping and perform subsequent testing in accordance with SCDHEC requirements.

Service Water System

Initial Configuration

In the initial configuration, the Domestic Water System is available to supply water to the Service Water Storage Tank. DCS controlled components and system valves are aligned in accordance with procedure 261-SOP-SW-01, *Service Water*.

Startup

In system startup, the Area Power Group is notified that a high demand will be placed on the Domestic Water System. Applicable isolation valves for headers and lines are opened as required.

ELO 1.13	**EXPLAIN the following normal operations of the Service Water System:** **a. Initial configuration** **b. Startup** **c. Normal operation** **d. Shutdown**

Normal Operation

Service Water is being supplied to all areas. Pump control circuitry is operational and monitored by the DCS. The DCS is monitoring and controlling system parameters.

The Service Water System performs functions in normal and abnormal operating conditions associated with Mode 1 (OPERATION), Mode 2 (WARM STANDBY), and Mode 3 (COLD STANDBY). Normal operating conditions are defined as those planned operations that are performed on a routine basis within the accepted operations and design parameters, and which involve steady-state operations or orderly transitions between operating modes.

Mode 1 - Operations

During Mode 1 operations, one service water pump is running at low speed supplying system loads. The remaining pumps are in standby and available for automatic start. The running pump is recirculating water to the Service Water Storage Tank. The level control valves in the Ash Handling and Offgas Systems open to replenish water levels reduced by system demands. Service water flow may be in operation to the Mist Eliminator (VAPX-001) and valve lineups are performed so that other systems receive service water when manually initiated by operators. Service water is available for fill and mixing of ash drums and decontamination of the Ashcrete Unit as required by the Ashcrete Local Control Room (ALCR) Operator. System flow, pressure, and pump status is displayed on the DCS in the Control Room.

Mode 2 - Warm Standby

During Mode 2 operations, one service water pump is running at low speed. Interfacing systems requiring service water include the Offgas System, the Ash Handling System to maintain water level in the Ash Receiving Tank and the Caustic System. Service water is available at any of the hose reel stations throughout the facility.

Mode 3 - Cold Standby

During Mode 3 operations, the system may be shut down for repairs or remain on-line to support CIF shutdown, as directed by the Shift Supervisor.

Shutdown

In shutdown, the CIF transition through the General Operating Procedures is complete and service water support is no longer required. The Shift Supervisor has directed that the system be shut down and procedure 261-SOP-SW-01, *Service Water,* be performed.

ELO 1.14 DESCRIBE the routine inspections and surveillances of the water systems.

Routine Inspections and Surveillances

Surveillance requirements for the Domestic and Service Water System are limited to periodic inspections of the systems piping, components, and connections. These inspections are performed during the fill and venting of system piping headers, as required by the applicable procedures. The purpose of the inspections is to verify no leakage which ensures that the structural integrity of system boundary is not compromised. Leakage observed at bolted connections and piping flanges is documented through the work control program, and work packages are prepared to correct discrepancies.

A vibration monitoring program monitors the performance of the service water pumps and analyzes data to detect trends that may indicate degradation.

Specific operator interaction may be required during certain operations. These actions include monitoring flow rate, monitoring pressure, performing periodic inspections for leakage from piping flanges and other critical connections, monitoring and maintaining adequate water level in the Service Water Storage Tank, and monitoring the service water pump operation.

Infrequent Operation

The Service Water System is a source of emergency cooling for the Offgas Quench System, and is required to be in operation when the Incinerator is operating. The Domestic Water System provides water to the safety showers and emergency eyewash stations. They are required to be operational and available when the facility is being operated. Almost any failure of the water systems will require a complete or partial shutdown of the CIF. This section describes some of the more common problems that may occur and corrective actions to be taken.

The Service Water System may be required to provide emergency spray water to the Quench Vessel. This operation is initiated by high quench vessel exhaust temperature (scrubber inlet temperature) or high scrubber outlet temperature.

ELO 1.15	**DESCRIBE the cause and consequences of abnormal operations associated with the water systems.**

Abnormal Operations

Domestic Water System

Header Failures

The failure of a domestic water header due to line breaks, blockage, or leakage will result in a partial or total loss of domestic water flow. This will result in the potential interruption of supply water to the service water, safety showers, and eyewash stations, and will require the shutdown of the facility.

Valve Failure

The failure of level control valve LCV-5050 will result in the total loss of flow to the Service Water Storage Tank. With a total loss of domestic water flow, a shutdown of the CIF must be initiated. The Service Water Storage Tank is designed to contain a two-hour (2) capacity of emergency offgas quench water.

Service Water System

Header Failures

The failure of a service water header due to line breaks, blockage, or leakage will result in a partial or total loss of service water flow. This will result in the potential interruption of water to the Quench Vessel (in an emergency), the Ash Receiving Tank, the Scrubber Recirculation Tank, and other areas requiring service water. The partial or total loss of water to these areas will require the shutdown of the facility.

Valve Failure

The failure of level and flow control valves to the Scrubber Recirculation Tank, the Quench Vessel Emergency Spray Chamber, the Ash Receiving Tank, or the Caustic Unloading Pump will result in the loss of water to those areas. Shutdown of the facility will be required.

Pump Failure

The loss of two service water pump(s) will result in the loss or reduction of flow to the CIF areas requiring service water. Loss of all service water pumps will require shutdown of the facility.

Loss of Power

The Standby Service Water Pump will automatically restart 10 seconds after the start of the quench recirculation pumps as required by the DCS Load Sequencer.

Summary

- Failure of the Domestic Water System will affect the safety showers and emergency eyewash station availability and may affect the availability of the Service Water System. This may require the shutdown of the facility.
- Loss of the Service Water System can have varying effects depending on which part of the system is lost. Operators may be required to shut down all or part of the incinerator operation to compensate for the loss of service water.
- The Domestic Water System is rarely out of service. Portions of the system may be isolated to perform specific maintenance, but system outages are infrequent.
- When bringing the system back in service, a flush is usually conducted, and water samples are collected and analyzed as required by the SCDHEC. System pressure is monitored and water is available on demand.
- The Service Water System normally operates with one pump running in slow speed, and the other two pumps in standby. Service water storage tank level is maintained by the level controller and system pressure. Flow and pump status are monitored by DCS in the Control Room.
- Systems loads are being manually controlled as Operations dictate. When required to be shut down, the system is shut down by the applicable operating procedure. Periodic maintenance consists of inspecting piping and components for leaks and checking pump operation, using vibration analysis and physical inspection.